Space Weather Technical Forecast

Issued on Saturday, 13 April 2024 at 13:26 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: G1/G2 Likely, peak Monday 15 April. Daily Chance of M-class X-ray flares.

Solar Activity: Solar activity has become Moderate, with a single M-class flare, peaking M2.4 at 13/0502 UTC from AR3637 in the southeast. There are now seven sunspot groups on the visible disc. Both AR3628 in the northwest and AR3636 in the southeast, displayed some peripheral spot development, gaining bipolarity. A continued spreading and growing tendency was displayed in AR3634 in the north-centre disk. Small intermediate spot development with a complexifying beta-gamma magnetic configuration was observed AR3635, in the northeast. The previously unnumbered spot in the southeast has been analysed as two separate regions, AR3637 and AR3638. These appear to be magnetically linked to a not yet visible region near the northeast limb.

No further Earth-directed CMEs have been detected.

Solar Wind / Geomagnetic Activity: Solar winds, as observed by DSCOVR at L1, showed a slow regime. The solar wind speed ranged from 380-430 km/s. Density remained below average. The IMF was weak and very steady at or below 5nT, while the north-south component ranged between +4/-3nT with an erratic tendency. The phi angle was mostly positive (away from the Sun). Resultant geomagnetic activity was Quiet (Kp 0-2).

Energetic Particles / Solar Radiation: High energy proton flux (greater than 10MeV) observed at GOES18 was at Background levels.

High energy electron flux (greater than 2MeV) observed at GOES16 was at Normal Background to Moderate levels, with a peak of 395pfu observed at 12/1455UTC. The associated 24-hour fluence remained below Active (1e8 integrated flux) with a value of 1.1e7 integrated pfu recorded at 13/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Low to Moderate solar activity is expected, with a chance of further M-class flares and a slight chance of X-class flares throughout.

Solar Wind / Geomagnetic Activity: Two potential Earth-directed CMEs feature in the forecast, one expected to arrive later on 14 Apr and the other early on 15 Apr. Otherwise, the slow-ambient solar winds may become slightly elevated from late 13 Apr should any fast wind from CH24/- arrive.

Geomagnetic activity is forecast to increase from Quiet levels to perhaps become Active from later 13 Apr from the onset of a coronal hole fast wind. Then, a Chance of G1/G2 Minor/Moderate geomagnetic storms late 14 Apr, rising into 15 Apr due to two inbound CMEs, especially if any arrivals combine. Activity should then ease back to mainly Quiet to Unsettled levels through 16 Apr.

Energetic Particles / Solar Radiation: High energy proton flux as observed by GOES18 is expected to persist at Background levels.

High energy electron flux at GOES16 is expected to temporarily decrease from a diurnal

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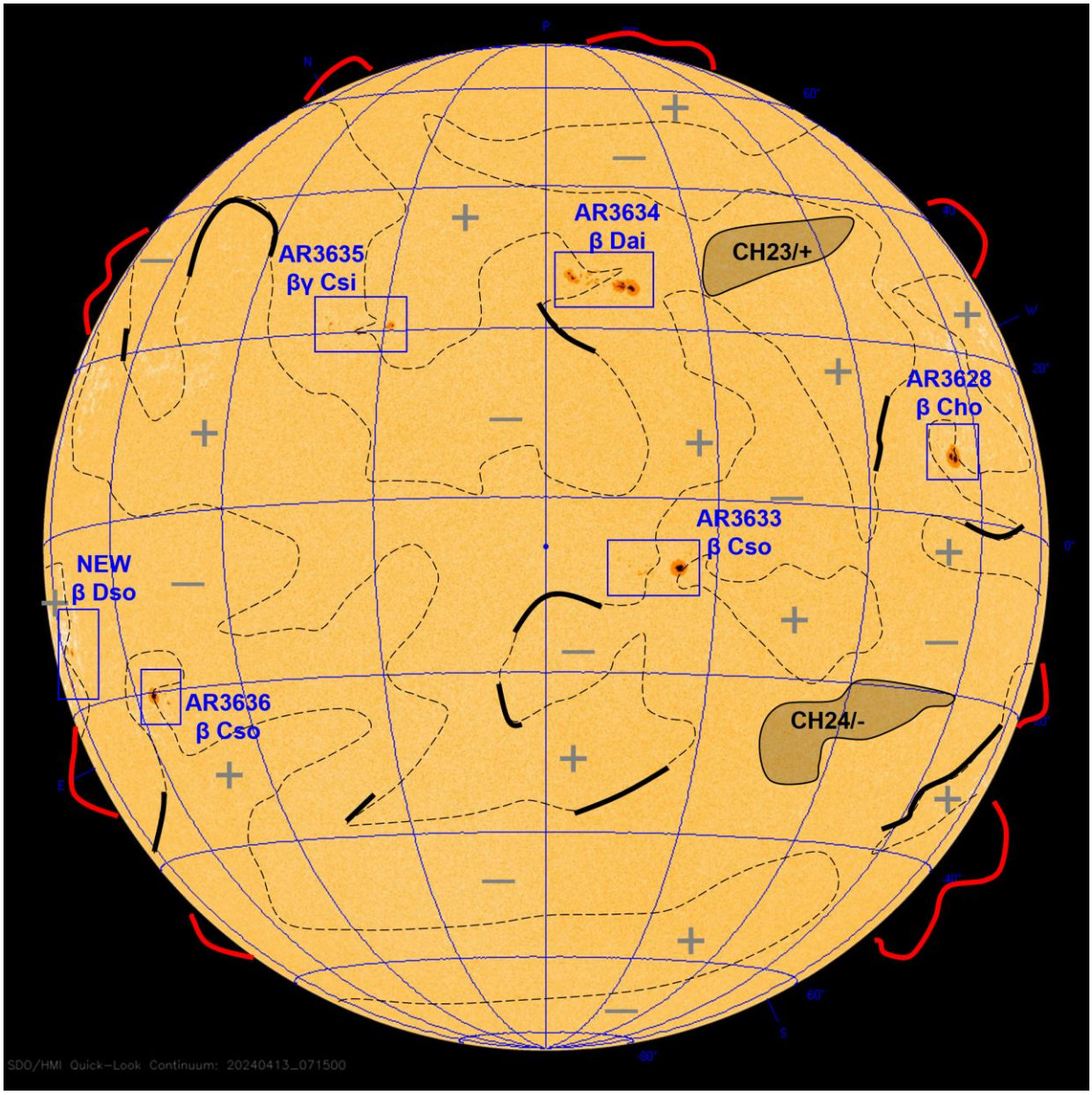
Moderate peak to Normal Background with the onset of any fast wind and then up to two CMEs, but presents a risk of rising by the end of the period to give a peak slight chance of Active 24-hour integrated fluence by this time.

Figure 1. Solar Analysis Valid 13/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

The geomagnetic forecast comprises up to two CMEs and a relatively minor fast wind onset.

There are up to two CMEs of note: the first is a a filament eruption from the north-centre filament eruption 11/0540UTC. Despite its original location in the northeast, this was seen as a faint partial halo to the southeast and is considered to have the potential to give a glancing impact late in the UTC day of Sunday 14 April. MOSWOC Enlil suggests a most likely arrival of 14/1900UTC, however this is likely to be on the early-end of estimates, as MOSWOC Enlil has overestimated wind speeds in recent days, likely providing less of a brake on this CME than the actual 400km/s solar wind in observations.

The second and perhaps more noteworthy CME in the forecast is the filament eruption observed just southwest of centre-disc around 12/0020UTC. The subsequent CME is very faint, but perceptible on SOHO C2 and STEREO A difference imagery, as a full halo. This has been analysed as an arrival very early in the UTC day of Monday 15 April. This CME will also likely suffer the same modelling discrepancy as the first, and the MOSWOC Enlil suggested arrival of 15/0100UTC is probably on the fast end of probable arrival estimates. This is the main reason for the late-skewed Likely G1/G2 over the two UTC days of 14 and 15 April, with activity perhaps peaking later in the UTC night separating the two days.

The fast wind forecast is very likely to be the minor factor in the geomagnetic forecast overall. A most likely arrival of the fast wind from CH24/- possible later in the UTC day of Saturday 13 April, continuing over the remainder of the weekend before CME influence likely comes to dominate. This is a recurrent feature, with 450km/s observed last rotation, while negative coronal holes are also still favoured for connection. However confidence is low due to the lack of notable enhancement observable in Enlil, besides the potential CME glance.

All considered, initially Quiet geomagnetic activity may increase to Active within the current UTC day, before more sharply increasing to round out the UTC weekend with the closely-spaced arrival of the 11/0540UTC filament and then the 12/0020UTC filament late on 14 and early on 15 April. Activity should have largely waned into the final day of the four, with Quiet conditions reinstated before midweek UTC.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	50	70	5
Strong	G3	No	1	10	10	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

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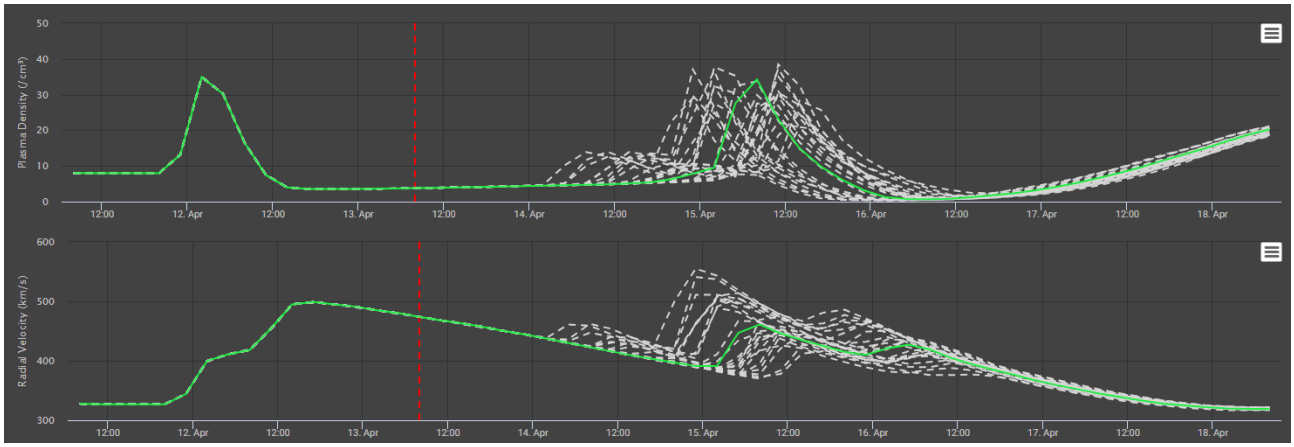
Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
12/0620	Full	Filament eruption	SW	670 km/s	Early UTC day 15 April	Fuller hit expected
11/0540	Partial	Filament eruption	NE	856 km/s	Late UTC day 14 April	Glancing blow, despite emission location

Figure 2: MOSWOC ENLIL Ensemble showing potential CME arrivals.



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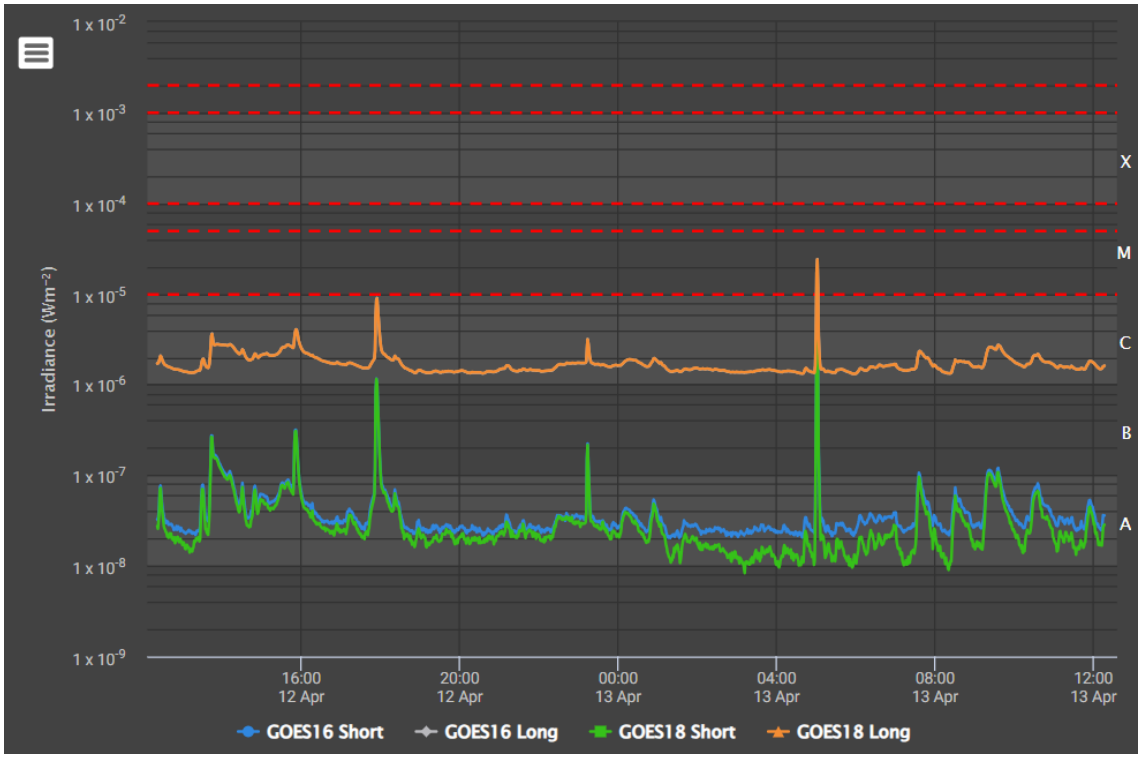
Radio Blackouts - X-Ray Flares:

Solar activity has become Moderate. Low or Moderate activity is expected to continue, with up to two large and previously active returning regions present near the eastern limb. There are now seven sunspot groups on the visible disc. Both AR3628 in the northwest and AR3636 in the southeast, displayed some peripheral spot development, gaining bipolarity. Ar3633 in the south-centre disk appears largely unchanged. A continued spreading and growing tendency was displayed in AR3634 in the north-centre disk. Small intermediate spot development with a complexifying beta-gamma magnetic configuration was observed AR3635, in the northeast. The previously unnumbered spot in the southeast has been analysed as two separate regions, AR3637 and AR3638. These appear to be magnetically linked to a not yet visible region near the northeast limb.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	Yes	50	50	50	50
Very Active	R3 to R5 X Class	No	10	10	10	10

Figure 3: 24 X-ray trace.



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Solar Radiation Storms - (High Energy Protons):

High energy proton flux as observed by GOES18 has remained at Background levels. Solar radiation storms are currently not expected, though a very slight chance is maintained throughout due with the number of active regions on the disk.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

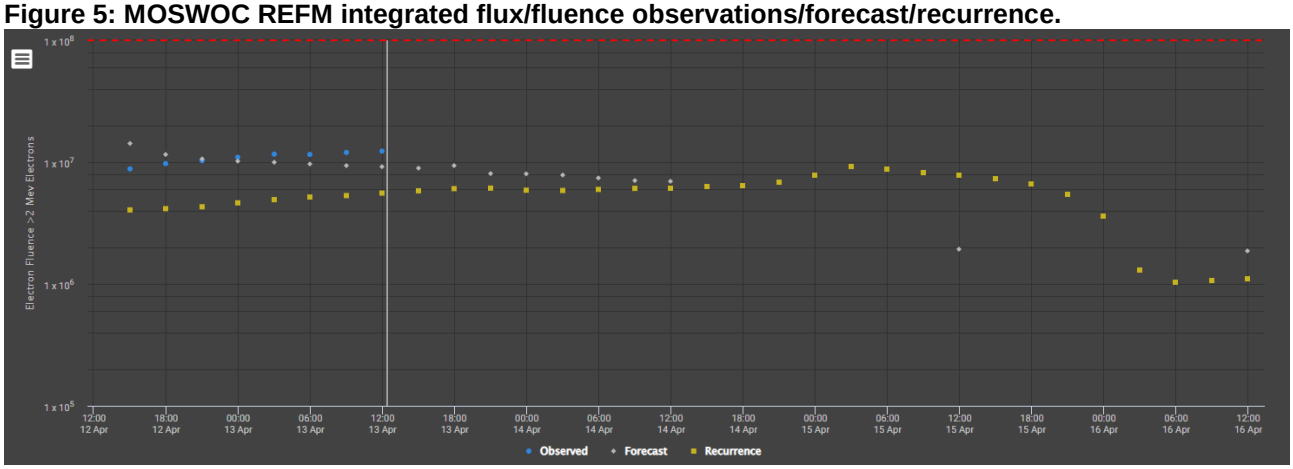
High Energy Electrons Event (≥ 2MeV):

High energy electron flux at GOES16 is expected to temporarily decrease from a diurnal Moderate peak to Normal Background with the onset of any fast wind and then up to two CMEs.

The extent of any rebound at GEO is uncertain by the end of the coming four-day period, but perhaps shows a peak slight chance of Active 24-hour integrated fluence by this time.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	1	20
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 5: MOSWOC REFM integrated flux/fluence observations/forecast/recurrence.



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